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ABSTRACT

Computer assisted instruction (CAI) may well represent the next phase in the involvement of the library or learning resources center with media and the educational process. The Lister Hill Center Experimental CAI Network was established in July, 1972, on the recommendation of the National Library of Medicine, to test the feasibility of sharing CAI materials through a national computer network. Three suppliers of CAI programs--Ohio State University, the Massachusetts General Hospital, and the University of Illinois Medical Center in Chicago--combined with one commercial time-sharing corporation to realize the network concept. CAI programs on the network are applicable to health science users at all levels and have been utilized by over 100 health science institutions. The network was initially free to users. While the institution of charges caused an initial drop in the number of users, their numbers have risen again, and the network is now self-supporting. This network method may be too expensive to allow most libraries to make effective use of CAI, but costs could be cut through the use of minicomputers and intelligent terminals. (Author/SL)

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MIND TRANSPLANTS OR: THE ROLE OF COMPUTER ASSISTED INSTRUCTION IN THE FUTURE OF THE LIBRARY

The concept of the word "library" has broadened a great deal over the past several years. Since the time of cuneiform tablets in the days of Sumeria, libraries have been concerned with storing and accessing recorded knowledge. For hundreds, even thousands of years, this recorded knowledge has been in book, manuscript, and picture form and only within the last 10 years have libraries and librarians become increasingly aware of "other media" as a source of recorded knowledge. More and more progressive schools have integrated these media into a new and bigger creature called the "learning resource center" which has combined the more traditional library functions and services with less traditional vehicles than the printed word.

What does the phrase "learning resource center" encompass and why should librarians be concerned with this recently evolved creature? The Carnegie Commission on Higher Education has answered the question this way:

> "Efforts to free libraries from the restraints of a totally print-oriented mission have been underway for many years. The advent of electronic media and new interest in instructional technology have reinforced this interest. One of the main reasons for changes in attitudes on this subject on the nation's campuses has been a realization that the resources of campus libraries (now frequently called information centers or learning-resource centers) have been inadequately utilized in the instructional efforts of colleges and universities. A

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manifestation of the new attitude is the physical location of the library at the core of the main instructional facility on several new, small campuses.

A longstanding objection of tradition-bound librarians to the new roles for information centers was breached in 1969 when a joint Committee of the American Association of School Librarians and the Department of Audio Visual Instruction of the National Education Association (now the Association for Educational Communications and Technology) issued a report strongly recommending unification of print and nonprint media in "media centers." As one writer said of the report, "... the Standards recommends a unified media program in which a single institution within the school provides all necessary materials for learning; and quantitatively it prescribed ways for achieving this objective. The words 'library,' 'librarian,' 'audiovisual center' and 'audiovisual specialist' are entirely supplanted by terms such as 'media center' and 'media specialist.' The media center will house all learning materials and accompanying services, putting audiovisual and printed resources under an allegedly more favorable single administrative organization and providing easier access for individual or group study."
(Carnegie Commission, 1972).

The handling of instructional media creates a totally new set of problems for the librarian who must become familiar with a new group of materials often requiring modifications and policy changes to existing

routines. These affect all areas including cataloging, classification, storage, and retrieval and circulation. In addition, these modalities require specialized equipment conjuring a myriad of nightmares associated with the procurement, care and feeding of this equipment.

Assuming the above does not paint a rosy picture, handling of media must be approached from a positive perspective. Other areas in librarianship present equally challenging facets--who among us has not struggled with the Anglo-American Cataloging Rules? Media or instructional technology are here to stay, in the opinion of the Carnegie Commission and in the opinion of educators of all types around the country. In the medical field, for instance, the Association of American Medical Colleges reports that of 135 medical schools in the U.S. and Canada, 101 have an established unit responsible for instructional material development and/or management of media.

The implications of this new technology are:

1. The library will become a more dominant feature of the campus.
2. Students will need more familiarity with computers as they enter college.
3. Faculty will need to be trained in the use of new technologies.

Up to this point, I have not addressed any specific type of media, but now I shall reveal my purposes for this lengthy preamble. The learning resource center of the present is primarily concerned with films, videotapes, cassettes, filmstrips, sound recordings, and many other audiovisual modalities. However, there is an important format on the horizon which many libraries have not yet explored and that is

computer assisted instruction (CAI).

CAI may well represent the next phase in the involvement of the library or learning resource center in the educational process. Let me begin my explanation of this statement by telling a bit about the Lister Hill Center and our experience with CAI.

The Lister Hill National Center for Biomedical Communications had its start in 1965, when the Committee on Appropriations of the House of Representatives encouraged the National Library of Medicine to develop a research capability. On August 3, 1968, President Lyndon Johnson signed Public Law 9-456 which authorized the Center. Soon after the establishment of the Center, Dr. Martin M. Cummings, Director of the National Library of Medicine, asked the Association of American Medical Colleges (AAMC) to take a leadership position in involving the academic medical community in planning a Biomedical Communications Network. A conference was held in February 1969 to consider the educational services that a network might provide (Smythe, 1969). Subsequently a request for more specific plans resulted in the production of a report from the Steering Committee, Council of Academic Societies, Association of American Medical Colleges (Stead, et al, 1971). The Steering Committee report included many recommendations, one of which is the following: "the Steering Committee advocates the organization of a biomedical communications network designed to meet some of the needs of medical education and medical practice and to capitalize on the current state of development of various phases of communications and computer technology. Of primary importance is the requirement to maintain a high level of learning experiences for growing numbers of students to whom medical, dental, nursing and other health career schools are committed."

The AAMC report was presented to the Board of Regents of NLM and the Board appointed a Priorities Review Committee to study the report. The Committee presented four recommendations which were adopted unanimously by the Regents. One of these recommendations has a direct bearing on the establishment of the Experimental CAI Network. It read:

> "The Committee advocates the organization of a biomedical communications network fundamentally conceived as providing the mechanism by means of which interinstitutional sharing of resources will be used to meet some of the needs of medical education." Implementation of this goal began in September 1971.

The Lister Hill Center Experimental CAI Network was established in July of 1972 in response to this recommendation, to test the feasibility of sharing CAI materials through a national computer network. Three suppliers of CAI programs and one commercial time-sharing corporation were under contract to the Library to collectively realize the network concept. The three centers of CAI expertise were the Ohio State University, the Massachusetts General Hospital and the University of Illinois Medical Center in Chicago. In January 1974, a decision to focus University of Illinois support on the PLATO (Programmed Logic for Automatic Teaching Operation) project necessitated UIMC's withdrawal from the network and since that time we have been operating with the two remaining systems. However, the Illinois CASE (Computer Aided Simulation of the Clinical Encounter) programs were subsequently transferred to the Ohio State computer.

The network configuration itself allows the OSU and MGH computers to be connected to the Tymshare network via minicomputers so that the

user need only call one location (their nearest network node), to be linked to either computer by telephone line. For many users this does not even involve a long distance telephone charge. This network also allows the programs to remain on the host computers so that maintenance and update responsibility reside with the program supplier.

There are programs on the network applicable to health science users in medicine, dentistry, nursing, pharmacology, and allied health at all levels--undergraduate, graduate and continuing education. Available programs include microbiology, genetics, biochemistry, physiology and anatomy in basic sciences, cardiopulmonary resuscitation, abdominal pain, diabetic ketoacidosis and coma in clinical simulations and several natural language interactive patient encounters in various specialty areas. These programs have been used in a variety of ways by over 100 health science institutions using from 1500 - 3000 hours of program time per month.

Network Costs

Costs are divided into three main categories: Tymshare costs, contractor costs, and NLM staff costs. The Tymshare cost is subdivided into fixed costs, which do not vary with increased usage, and variable costs. The fixed costs include the rental of the interface mini-computers at each site, maintenance of the user name file, cost per log-in, and invoice preparation. The variable portion of the Tymshare cost is broken down into connect time and characters transmitted.

The contractor costs are divided into two parts: part 1, the charge for the computer costs, part 2, the charge for personnel support.

Table 1 shows the total CAI cost per terminal hour. The table assumes 1800 terminal hours per month usage.

Table 1

Total CAI Costs Per Terminal Hour[a]

Component	Cost (per Terminal Hour)[b]
TYMSHARE variable communication cost	$ 5.43
TYMSHARE fixed communication cost (TYCOMS, user names, invoice preparation)	3.28
Computer port charges	4.66
Computer host personnel support costs	4.69
NLM Central Staff	1.66
Total cost per terminal hour[b]	$19.72

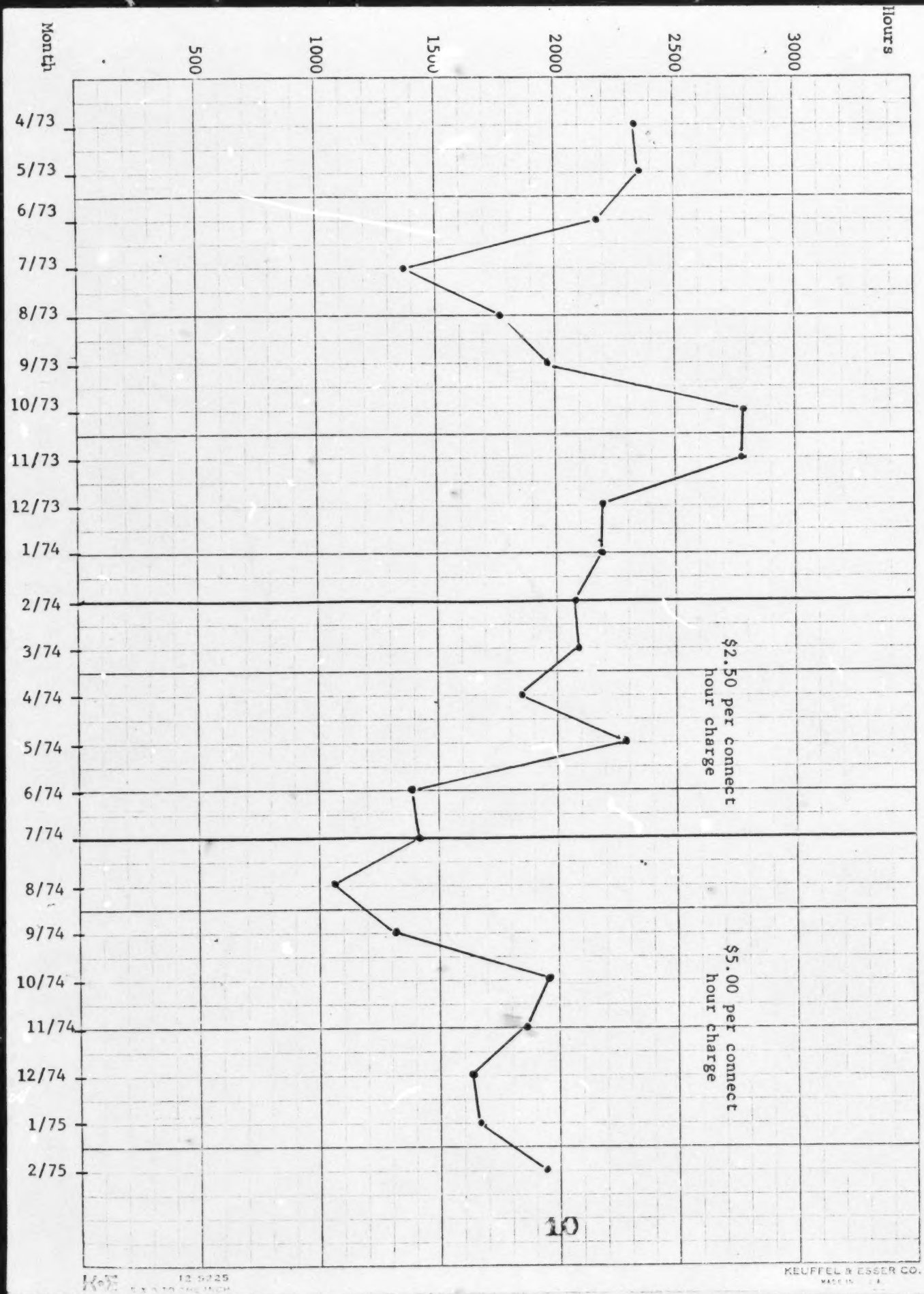
[a]Does not include user institution costs for terminals, personnel, materials, or local communications facilities.

[b]Terminal hours are not always the same as student instruction hours. Students may work together in small groups.

Initially the network was free to users. It was later decided to have network users pay an increasing portion of the cost. In February 1974, the cost began at $2.50 per hour and in July, 1974, it was raised to $5.00 per connect hour.

Although user charges caused a drop in the number of institutions who had access to the programs, that number has risen to a peak at the present time, of over 75 users. The number of hours used also dropped, but has been slowly increasing over the past few months (see Table 2). The interest that has been generated in the network is evidenced by the evolution of an active user group. Largely due to the fact that the Library announced at least a year ago that it would not fund the network after May 31, 1975, users formed the Health Education Network Users Group (HENUG) to investigate means of making the programs available after May 31. This group has negotiated with Ohio State, Massachusetts General and Tymshare and produced plans for what they hope will be a viable continuation. For an $8.00 - $10.00 per hour charge, users will be able to access the CAI programs through Tymshare for a period of 10 additional months. During this time, HENUG plans to explore alternatives to the present configuration hoping to decrease hourly rates.

The Experimental Network and user group are unique to networking and to the field of computer-assisted instruction. The network was the first national attempt to make CAI available across institutional lines and it brought this form of instructional material to the attention of many persons who would otherwise not have had the opportunity to examine programs and student reactions to the programs on a local level. The user group is unique in that they are the first group to attempt


Hours
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$2.50 per connect hour charge
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Table 2

networking on a self-supporting basis. At the present time we have no real feeling for the success or failure of this effort, but it is an important step toward the inter-institutional sharing of resources.

The conclusion reached by many as a result of the experiment is that CAI in health science is in its infancy, but that it is a viable teaching/learning modality. However, in the early stages of the network, we were not acute in our perception of where CAI should be marketed. At the insistence of the contractors, we deliberately aimed at the departmental faculty, by establishing a dichotomy between "operational" and "trial" users, and insisting that the "operational users" submit an Educational Material Use and Evaluation Plan, promise to strive to integrate our course offerings into their curricula, and even train their faculty to produce additional units of instruction. We did not, perhaps because it would have been too easy, circularize our MEDLINE users. We were polite to those few librarians who did manage to find out that the network existed, but gently indicated that they could not possibly muster the faculty involvement required to do all the good things that we wanted. One such librarian put the quietus to that argument by returning the next week with his Dean in tow, and said, "Would you mind repeating that part where I can't get faculty involvement?"

Despite this negative advertising, we found that a large number of the terminals on our network, some of our major users, in fact were in libraries. Table 3 shows a location breakdown of terminals used for CAI. Table 4 shows that of the 10 largest users, 9 were centers managed by libraries or learning resource centers.

Given that instructional technology, and more specifically, computer-assisted instruction, is here to stay, how can librarians use

Table 3

Location of CAI Terminals on LHC Experiment

Location	Number
Libraries and Learning Resource Centers	48
Medical School Departments	23
Computer Laboratories	18
Terminal Rooms	5
Student Study Areas, Residents Lounges	5
Conference Rooms	4
Offices of Medical Education	4
Physician's Offices	4
Emergency Rooms	3
Ward Rooms	2
Cardiac Care Units	2

Table 4

Location of Terminals with Highest Mean Usage

Institution	Terminal Location
University of California - Los Angeles	Library
University of Pennsylvania	Library
Harvard Medical School	Library
Medical College of Virginia	Library
University of Washington	Learning Resource Center
University of Texas - San Antonio	Library
Stanford University	Learning Resource Center
University of Arizona	Library
George Washington University	Library
University of Oregon	Computer Center and Educational Resources Facility

it to their advantage? The network concept has demonstrated that schools are willing to share CAI materials; however, the present configuration is too costly for the long run. Therefore, alternative distribution methods must be explored. We are looking at computer language translation to allow wider distribution of existing and future materials, which would spread developmental costs more evenly. We are also examining the use of minicomputers at the institutional level for providing programs to on-site users.

The minicomputer has advantages for both the library and the development of CAI. In CAI it allows the creation and maintenance of programs at an individual institution alleviating problems of tailoring imported materials to fit a curriculum. Also, a minicomputer is a far less expensive piece of computer equipment to procure than a monstrous central computer. Its use lowers communications costs, which can be prohibitive to the user in Boise, Idaho, whose nearest network node is in Denver.

As far as the library is concerned, a minicomputer can be the answer to problems in library automation. Strides are being made toward use of the mini for library systems and its use in this activity has benefits, many of which are common to CAI. At the University of Minnesota Bio-medical Library, Glenn Brudvig and his staff are designing a total library system supported by a minicomputer and funded through a grant from NLM's Extramural Programs Division. A brief survey of automation projects, however, reveals that few libraries have discovered the virtues of minicomputers. A local minicomputer is less expensive to obtain and operate than a

larger configuration. In addition, the larger computer is nearly always shared with other parts of the institution and frequently the library functions are of low priority. This means that systems must be designed to run in batch mode to be updated during non-prime hours, and often the librarian does not have access to the file during regular work hours. The combined needs of a CAI system and automation project in the library could conveivably justify the procurement of a minicomputer for use by the library or learning resource center.

Another alternative to large network CAI also has implications for the library. We are currently exploring the use of "intelligent terminals" for the purpose of supplying CAI. An intelligent terminal is simply a desk top device with keyboard display and a small memory, which is entirely self-contained. By plugging the terminal into the wall and loading the CAI program by cassette tape, an entire program library can be made easily available. This device lends itself particularly well to use in the library because it requires little technical knowledge, no programming support and does not depend upon the up-down time of a larger computer.

The writing of new programs is also simplified by an authoring language which has been tailored specifically to the intelligent terminal. PILOT, as the language is named, can eliminate the authoring stumbling block by encouraging faculty to attempt creation of their own programs. Previous to this, most authoring has been done in conjunction with programmers because of the technical level of the authoring language. This has discouraged many faculty members who do not have the time or inclination to spend with a more cumbersome process.

SUMMARY

Some years ago, a colleague of mine was approached by a very slick, very professional salesman for a commercial abstract service. He raised an eyebrow at the price, over a thousand dollars a year, and asked what luck the salesman had in selling his service to libraries. He said "I don't sell it to libraries. It's too expensive for them. I sell it to Directors of Research, who keep it in their offices."

Computer-assisted instruction has had similar problems over the years. Academic departments, computer science laboratories and specialists in instructional technology have combined forces to develop these programs. The pathways from computer to user have all too often bypassed the library. Librarians may well have been aware of these programs, but never thought of them as coming within their scope.

We think that libraries will find computer-assisted instruction a useful service to offer their clientele. However, it is wise to keep in mind the fact that CAI is different from other library and audiovisual materials. CAI is a living, pulsating, dynamic tool which involves the user actively and we think that this makes it an even more desirable addition to the library. Dr. David Kronick, Librarian at the University of Texas Health Center, San Antonio, said: "Anyone who sits at a terminal interacting with a computer based teaching program must feel the presence of another fine and active intelligence who is using the computer as an effective intermediary and thus providing greater access to his teaching skills." (Kronick et al, 1974).

The fact that CAI lives is evidenced by comments received from students themselves:

"We were going to be married."

and more serious remarks, such as:

"It was very useful to help develop clinical judegments."

"This program was realistic, stimulating, and a good review of a topic which many internists lose familiarity with soon after leaving their residency and fellowship years."

"Although I realize that the computer is expensive, I feel that its use by students is extremely beneficial."

Although computer-assisted instruction is still in the experimental stages, its potential as a learning resource is becoming more and more apparent. However, I hope that every learning resource center of the future, no matter how many minicomputers, intelligent terminals, video tape projectors and bio-feedback sensory learning carrels, will have somewhere a glass case containing a book, a packet of waterproof matches, a candle, and a sign reading: IN EVENT OF POWER FAILURE BREAK GLASS.

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